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## **REMARKS**

Claims 20-30 and 32-55 are now present in the application. Claims 20, 24, 27, 37 and 40 have been amended, claims 1-19 and 31 have been canceled and claims 45-55 have been added. Claims 20, 27, 32, 40, 47 and 51 are independent. Reconsideration of this application, as amended, is respectfully requested.

### **Information Disclosure Statement**

Information Disclosure Statements were submitted to the U.S. Patent and Trademark Office on September 20, 2001 and November 8, 2001. Applicants acknowledge receipt of the initialed PTO-1449 form from the Information Disclosure Statement dated September 20, 2001. However, Applicants have not received an initialed copy of the PTO-1449 attached to the Information Disclosure Statement dated November 8, 2001. Accordingly, it is respectfully requested that the Examiner provide an initialed copy of the PTO-1449 attached to the Information Disclosure Statement dated November 8, 2001 with the next Official Communication in order to indicate that the Examiner has considered the references listed thereon in the present application.

### **Status of the Drawings**

In the Examiner's Office Action dated November 5, 2003, no indication as to the status of the drawings has been provided. The present application was filed with seven (7) sheets of formal drawings as indicated on the transmittal letter dated July 11, 2003. It is respectfully

requested that the Examiner indicate whether the drawings are acceptable so that Applicants can make any necessary drawing corrections in a timely manner.

### **Restriction Requirement**

Claims 1-19 and 31 stand withdrawn from further consideration as being directed to a non-elected invention. As the Examiner will note, claims 1-19 and 31 have been canceled without prejudice or disclaimer of the subject matter contained therein. Applicants reserve the right to file a Divisional Application directed to these claims at a later date if it is so desired.

### **Rejections Under 35 U.S.C. §§ 102 and 103**

Claims 20, 21, 32 and 33 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Prentice et al., U.S. Patent No. 6,541,063. Claims 20, 25, 32 and 38 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Tanaka et al., U.S. Patent No. 6,036,994. Claims 20, 26, 32 and 39 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Radowicz et al., U.S. Patent No. 6,033,503. Claims 27-29, 40-42 and 44 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Motooka Osamu, JP 02-200376 (hereinafter "the JP '376 reference"). Claims 22-24, 34 and 36-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Prentice et al. as applied to claims 20 and 32 above and further in view of Ciardella et al., U.S. Patent No. 5,711,989. Claim 35 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Prentice et al. as applied to claim 32 above and further in view of Louis Vanyi, U.S. Patent No. 3,580,462. Claims

30 and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the JP '376 reference as applied to claims 27 and 40 above and further in view of Berg et al., U.S. Patent No. 6,450,416.

At the outset, it is respectfully noted that the Prentice et al. reference relied on by the Examiner is not an appropriate reference against the present invention under 35 U.S.C. § 102(e). The Examiner has relied on the Prentice et al. reference as of the filing date of U.S. Provisional Application No. 60/163,517, filed November 4, 1999. A copy of the '517 Provisional Application is enclosed herewith for the Examiner's consideration.

Upon a review of the '517 Provisional Application, it can be readily determined that there is no disclosure therein that would provide support for the later filed U.S. Application No. 09/705,080, which resulted in the Prentice et al. reference. For example, there is no disclosure in the '517 Provisional Application with regard to an "inspection means" or "inspection device" as recited in independent claims 20 and 32, respectively. In view of this, the Prentice et al. reference is not available as a reference as of the filing date of the '517 Provisional Application, but is only available as a reference as of the filing date of the '080 Application of November 2, 2000.

In view of the above, the effective date of the Prentice et al. reference is prior to the U.S. filing date, but is after the filing date of the foreign priority document SE 0002618-7 of July 11, 2000. However, the Swedish priority document was filed in the Swedish Patent Office in the English language and a copy of this document was submitted to the U.S. Patent and Trademark Office on September 20, 2001. In view of this, the claim for foreign priority has been perfected in

the present application to July 11, 2000, which is prior to the effective date of the Prentice et al. reference.

In view of the above, the Examiner's rejection of claims 20, 21, 32 and 33 under 35 U.S.C. § 102(e) in view of the Prentice et al. reference is improper and should be withdrawn. In addition, the Examiners rejections of claims 22-24 and 34-37 under 35 U.S.C. § 103(a) in view of the Prentice et al., Ciardella et al. and Louis Vanyi references are also improper and should be withdrawn.

With regard to the Examiner's rejection of independent claims 20 and 32 under 35 U.S.C. § 102(b) in view of the Tanaka et al. reference, Applicants respectfully submit that the Examiner's rejection is also improper and should be withdrawn. Tanaka et al. discloses a screen printing apparatus which includes a method of aligning a screen plate 4. Referring to Figure 2 of Tanaka et al., apertures 18 in the screen plate are aligned with corresponding lands 19 on a circuit board 1. The lands 19 are the locations on the circuit board 1 where viscous material is to be applied; however, at the time of aligning the screen plate 4, no viscous material has yet been applied. In view of this, the Tanaka et al. reference fails to disclose "inspection means for inspecting the results of said application" as recited in independent claim 20 of the present invention or "an inspection device for inspecting the results of said application" as recited in independent claim 32 of the present invention.

In the Examiner's Office Action, the Examiner considers the camera 6 to be the inspection means or inspection device of the presently claimed invention. It is the Examiner's position that the

camera recognizes positions of the patterns and therefore is sufficient to teach the inspection means or inspection device of the presently claimed invention. Applicants respectfully submit that this position by the Examiner is unreasonable. Independent claims 20 and 32 specifically recite that the inspection means or inspection device inspects "the results of said application." In view of this, a means or device that performs inspection prior to application would not be sufficient to meet the above aspect of independent claims 20 and 32 of the present invention.

In view of the above, Applicants submit that the Tanaka et al. reference fails to anticipate independent claims 20 and 32 of the present invention. Accordingly, it is requested that the Examiner reconsider and withdraw the rejection of these claims under 35 U.S.C. § 102(b) in view of the Tanaka et al. reference.

With regard to the Examiner's rejection of independent claims 20 and 32 in view of the Radowicz et al. reference, Applicants respectfully submit that the Examiner's rejection is improper and should be withdrawn. Radowicz et al. is directed to an adhesive sensing assembly for an end jointed beam. Referring to Figure 1b of Radowicz et al., a first beam 104 is illustrated, which includes fingers 108 cut therein. The top surfaces of the fingers 108 include an adhesive coating 120 thereon.

Referring to the Examiner's Office Action, the Examiner considers the imperfection processor 222 to be the "correction means" or the "correction device" as recited in independent claims 20 and 32, respectively, of the present invention. Referring to column 6, lines 43-59 of Radowicz et al., the indicating mechanism is described as being a dye dispensing mechanism that

marks a defective beam, so that the defective beam can be clearly identified. In addition, at column 6, line 60 through column 7, line 2 of Radowicz et al., the indicating mechanism is described as being an “imperfection processor.” Examples of imperfection processors are disclosed as an air kicker for removing the work piece or a light that turns on or a horn that sounds when an imperfect work piece is detected.

The above disclosure in Radowicz et al. regarding the indication mechanism 222 is insufficient to teach the “correction means” or “correction device” of the presently claimed invention, since this mechanism merely identifies a defective work piece. Referring to column 7, lines 3-40 of Radowicz et al., it is described that a defective work piece “may be removed from end-jointed beam assembly line 200” or if a predetermined number of work pieces are identified, the assembly line 200 can be “taken off-line to address the issue of defective work pieces.” This disclosure in Radowicz et al. is also insufficient to disclose the “correction means” or the “correction device” of the presently claimed invention, since there is no indication of what happens to the work pieces when they are removed from the assembly line 200 or the assembly line 200 is taken off line.

In the Examiner’s Office Action, the Examiner states “imperfection processor 222 taking the defective work pieces off-line to address the issue of defective work pieces capable of having correction means.” The Examiner has failed to establish a *prima facie* case of anticipation. There is absolutely no teaching in the Radowicz et al. reference of any type of correction means or device. Merely removing work pieces from an assembly line or shutting down an assembly line is

insufficient for such a teaching. At the very most, Radowicz et al. is sufficient to disclose the background art described at page 1, lines 25-31 of the present specification, i.e., a board having an error is removed from the process and possibly cleaned and returned to the beginning of the process. This is insufficient to disclose “correction means” or a “correction device” as in the presently claimed invention.

With specific regard to the Examiner’s statement that the imperfection processor 222 is “capable of having correction means,” Applicants reiterate that there is no teaching in Radowicz et al. of a correction means or a correction device. In addition, the correction means and the correction device in independent claims 20 and 32 are not merely a function of the apparatus for providing a substrate with viscous medium, but are particular elements of a claimed combination. In view of this, whether the imperfection processor 222 is “capable of” of having correction means is irrelevant with regard to Radowicz et al. actually disclosing the correction means or device of the presently claimed invention.

In view of the above, Applicants submit that the Radowicz et al. reference fails to anticipate independent claims 20 and 32 of the present invention. Accordingly, it is requested that the Examiner reconsider and withdraw the rejection of these claims under 35 U.S.C. § 102(b) in view of the Radowicz et al. reference.

With regard to the Examiner’s rejection of independent claims 27 and 40 in view of the JP ‘376 reference, Applicants submit that the Examiner’s rejection is improper and should be withdrawn. As the Examiner will note, independent claims 27 and 40 are directed to an apparatus



for correcting application errors in connection with application of viscous medium on a substrate, wherein a combination of elements is recited including correction means or a correction device “for correcting at least some of said errors based on said information prior to hardening of the viscous medium.” The JP ‘376 reference fails to disclose this aspect of the presently claimed invention.

The JP ‘376 reference is directed to an apparatus for detecting defects in solder. Referring to Figure 4 of the JP ‘376 reference, the solder is used to mount components 19 onto a circuit board 18. Once a component 1 is mounted on a circuit board, the solder hardens to secure the component in place. In view of this, the correction in the JP ‘376 reference does not occur “prior to hardening of the viscous medium” as in the presently claimed invention. The correction in the JP ‘376 reference occurs after the solder has hardened.

Since the JP ‘376 reference fails to disclose a correction means or a correction device that corrects errors “prior to hardening of the viscous medium,” Applicants respectfully submit that this reference fails to anticipate independent claims 27 and 40 of the present invention. Accordingly, reconsideration and withdrawal of the Examiner’s rejection under 35 U.S.C. § 102(b) in view of the JP ‘376 reference are respectfully requested.

With regard to dependent claims 21-26, 28-30, 32-39 and 41-44, Applicants respectfully submit that these claims are allowable due to their respective dependence on independent claims 20, 27, 32 and 40, as well as due to the additional recitations in these claims.

With specific regard to Berg et al. reference relied on by the Examiner, this reference has only been relied on for a teaching of a jetting device. This reference also fails to disclose a

correcting means or device for correcting errors “prior to hardening of the viscous medium.” Accordingly, Berg et al. fails to make up for the deficiencies of the JP ‘376 reference.

In view of the above amendments and remarks, Applicants respectfully submit that claims 20-30 and 32-44 clearly define the present invention over the references relied on by the Examiner. Accordingly, reconsideration and withdrawal of the Examiners’ rejections under 35 U.S.C. §§ 102 and 103 are respectfully requested.

#### **Additional Claims**

Additional claims 45-55 have also been added for the Examiner’s consideration. Applicants respectfully submit that additional dependent claims 45 and 46 are allowable, due to their respective dependence on independent claims 27 and 40, as well as due to the additional recitations in these claims. With regard to additional claims 47-51, it is believed that these claims also define the present invention over the references relied on by the Examiner.

Favorable consideration and allowance of additional claims 45-55 are respectfully requested.

#### **CONCLUSION**

Since the remaining references cited by the Examiner have not been utilized to reject the claims, but merely to show the state of the art, no further comments are deemed necessary with respect thereto.

All the stated grounds of rejection have been properly traversed and/or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently pending rejections and that they be withdrawn.

It is believed that a full and complete response has been made to the Office Action, and that as such, the Examiner is respectfully requested to send the application to Issue.

Applicants respectfully petition under the provisions of 37 C.F.R. § 1.136(a) and § 1.17 for a one-month extension of time in which to respond to the Examiner's Office Action. The Extension of Time Fee in the amount of \$55.00 is attached hereto.

In the event there are any matters remaining in this application, the Examiner is invited to contact Paul C. Lewis, Registration No. 43,368 at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By. 

Paul C. Lewis  
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PCL/cl

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Attachment: U.S. Provisional Application No. 60/163,517

P1 339341

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# THE UNITED STATES OF AMERICA

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United States Patent and Trademark Office

3

January 17, 2001

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APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A  
FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 60/163,517

FILING DATE: November 04, 1999

PCT APPLICATION NUMBER: PCT/US00/30301



By Authority of the  
COMMISSIONER OF PATENTS AND TRADEMARKS

*M. K. Hawkins*

M. K. HAWKINS  
Certifying Officer

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A/PRN

Attorney Docket No. 17549-083

Applicants: Thomas Prentice and Brian P. Prescott  
Serial No. Not assigned  
Filed: November 4, 1999  
For: METHOD AND APPARATUS FOR CONTROLLING A  
DISPENSING SYSTEM

Examiner: Unassigned  
Art Unit: Unassigned

BOX PROVISIONAL APPLICATION (FEE)  
Assistant Commissioner for Patents  
Washington, D.C. 20231

TRANSMITTAL LETTER

Sir:

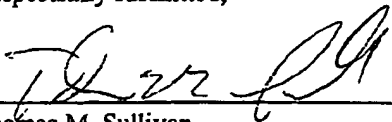
Transmitted herewith for filing in the present application is the following document:

☒ PROVISIONAL APPLICATION

If the enclosed papers are considered incomplete, the Mail Room and/or the Application Branch is respectfully requested to contact the undersigned at 617/542-6000, Boston, Massachusetts.

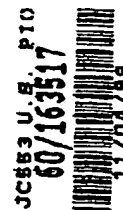
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Respectfully submitted,

  
\_\_\_\_\_  
Thomas M. Sullivan

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Date: November 4, 1999  
Attorney Docket No. 17549-083  
TRADOC5:1259958.1(R06%011.DOC)



Attorney Docket No.: 17549-083

PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 C.F.R. §1.53(c).

Express Mail Label No. EJ695377935US

Date of Deposit: November 4, 1999

INVENTORS/APPLICANTS

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Title of Invention:

**METHOD AND APPARATUS FOR CONTROLLING A DISPENSING SYSTEM**

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Enclosed Application Parts:

☒ Specification (Total 3 Pages);

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No

☐ Yes, the name of the U.S. Government Agency and the Government Contract Name are:

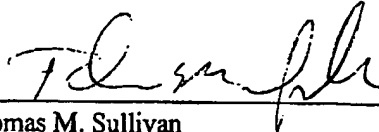
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Provisional Filing Fee Amount \$150.00

Respectfully submitted,



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Date: November 4, 1999  
Attorney Docket No. 17549-083  
TRADOCs:1259960.1(R06W011.DOC)

Application for United States Letters Provisional Patent

For

**METHOD AND APPARATUS FOR CONTROLLING  
A DISPENSING SYSTEM**

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Express Mail Label No. EJ695377935US  
Date of Deposit: November 4, 1999



## METHOD AND APPARATUS FOR CONTROLLING A DISPENSING SYSTEM

### Introduction:

As semiconductor packaging technology advances, so too does the need for better and more accurate fluid dispensing technology to support this application. Manufacturers who use dispensing systems to encapsulate and underfill any of a variety of semiconductor packages demand ever more accurate and repeatable means for controlling the dispensing process.

### Abstract:

In the past, dispensing systems strove to achieve a constant dispensing rate. In prior art systems, the dispenser valve in a dispensing system may be moved from one position to another at a fast or slow traverse speed, and turned on or off as required by the pattern to be dispensed. But the underlying premise of controlled dispensing has been the ability to achieve a substantially uniform rate of material delivery.

In some prior art dispensing systems, such as that disclosed in U.S. Patent No. 5,906,682, which is incorporated herein by reference, the addition of a weight scale to the dispensing process improves the accuracy and repeatability of the process by measuring the actual material flow rate being achieved, and adjusting the dispenser's traverse speed as necessary to compensate for any long term variations. Inherent in this approach is the assumption that the flow rate is constant over the short term. However, in reality, fluid flow is seldom constant. Certainly the steady state material delivery rate cannot be achieved instantaneously, nor can the positioning system be accelerated or decelerated instantaneously. These nonlinear transitions result in discrepancies between predicted and actual material amounts. In embodiments of the present invention, to overcome these shortcomings, a different approach has been taken; the presence of these nonlinearities is acknowledged and their effects is captured by duplicating them during weight scale sample dispensing.

### Summary of the Present Invention:

In one embodiment of the present invention, the dispensing pump is driven as a fully servoed axis. This allows coordination of the pump auger rotation with the traverse motion of the dispenser valve positioning system. For example, as the gantry accelerates out of a turn, so too does the pump. In this manner, a controlled material amount per distance traveled can be provided. In embodiments of the present invention, the ratio of pump auger rotation to the

horizontal distance traversed is defined as "Line Width", and this ratio is represented in units of degrees of auger per distance (e.g. deg/mm). Second, an entire pattern of dispensed features that is associated with the target weight is weighed during a calibration routine. Rather than measuring a dispense rate and extrapolating this rate to predict a pattern weight, as is done in the prior art, in embodiments of the present invention, the entire pattern is weighed and compared with the target weight. In this manner, all of the nonlinear effects of starts and stops of the pump and the gantry system are accounted for in any calibration weight measurements. Finally, when adjustments are made to compensate for discrepancies between measured and desired target weights, it is the Line Width ratio that is varied in embodiments of the present invention.

It should be noted, that in some embodiments of the present invention, the maximum RPM of the auger is limited, and therefore, one effect of varying the Line Width is that the maximum traverse speed varies as the systems converges on the desired target weight. If the maximum traverse speed were limited instead, the maximum RPM could be varied to control the weight dispensed.

#### **Example of the prior art approach in U.S. Patent No. 5,906,682**

The dispense rate is measured over a relatively limited period of time. The operator sets up a sample dispense routine as N shots, of M seconds each, with P seconds of pause between shots (e.g. 15 shots of 1 sec each, with .5 sec pauses (parameter names are mine). The total amount dispensed is weighed and divided by the total on time of the pump (e.g.  $187.5 \text{ mg}/15 \text{ sec} = 12.5 \text{ mg/sec}$ ). This measurement is then used to calculate other control parameters for the dispenser. For example, since the system "knows" the target weight of the pattern to be dispensed (e.g. 100 mg), the on time of the valve may be determined. (e.g.  $100\text{mg} / (12.5 \text{ mg/sec}) = 8 \text{ sec}$ ). Furthermore, since the distance to be traversed is known (e.g. 20 mm), the average traverse rate can be calculated (e.g.  $20\text{mm}/8 \text{ sec} = 2.5 \text{ mm/sec}$ ). This value can then be used to control the gantry speed.

#### **Example of approach of embodiments of the present invention**

Before beginning the actual sample to be weighed, the needle of the dispensing system is moved over the sample cup and a small amount is dispensed. This initial dispense causes a small tail of material to form on the end of the needle. The scale is zeroed out. Using some initial line width as a starting point (e.g. 120 deg/mm), the full pattern is dispensed into the sample cup. Since the tail of material remaining at the end of the sample dispense is substantially the same as the tail that was established before the sample, the material landing in the cup is substantially equal to

the actual amount that flowed through the needle. The sample is weighed (e.g. 160 mg), and compared to the target weight and tolerance range (e.g. 200 mg  $\pm$  2%). The target weight is divided by the actual weight to determine an adjustment ratio (e.g. 200 mg/160 mg = 1.25), and this ratio is multiplied by the line width used during the sample dispense to arrive at a new line width (e.g. 1.25 \* 120 deg/mm = 150 deg/mm). The sample weighing and adjustment process is repeated until the sample weight is within the target range. Since the amount of material delivered is very linearly related to the line width, this converging process is quick. Usually the second sample will be within the range, occasionally it takes a third pass. Once a line width is found that achieves the desired target weight, the system moves to a "pre-dispense plate" where the material tail is eliminated. The system is then ready to dispense onto actual parts.

When pattern samples are being dispensed into the weighing cup, a special scaling algorithm is used to keep the needle over the cup. The original pattern consists of pump moves tightly coordinated and synchronized with traverse moves (X-Y). Since the extents of movement during the pattern (e.g. 25 mm) would typically cause the needle to move away from the center of the cup, the original X-Y pattern is significantly scaled down (e.g. 25 mm/100 = 0.25 mm). The line width is scaled up by the same factor (e.g. 100 \* 150 deg/mm = 15000 deg/mm). It can be easily observed that the two scaled factors will cancel each other out, causing the pump to follow the same velocity profile as is would during a non-scaled dispense (e.g. 25 mm \* 150 deg/mm = 3750 deg = 0.25 mm \* 15000 deg/mm). This scaling allows the sample dispensing routine to run using the identical code that is used to perform real dispensing. All of the coordination between X-Y and the pump is maintained, as are all of the starts, stops and acceleration/deceleration profiles.